

Tracing downriver mining contaminants using Sm-Nd and Sr isotope signatures: the case of the iron-rich tailings from the failed Fundão dam at Mariana along the Doce River, southeast Brazil

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This work presents new TIMS Sm–Nd and Sr isotope data on the fine-grained fraction ($< 74 \mu\text{m}$) of iron-rich fluvial sediment related to the November 5th, 2015 Mariana accident, caused by the failure of the Fundão dam, an iron tailings pond operated by SAMARCO Mining, a Vale and BHP joint venture. The rupture of the Fundão dam caused the sudden release and gravitational flow of approximately 62 Mm^3 of quartz and iron oxide-rich slurry composed of water, fine sand and silt that flowed into the Gualaxo do Norte and Carmo rivers, and eventually along the whole Doce River, reaching the shoreline in 15 days. The event is considered the most serious environmental disaster, having caused 17 casualties and environmental impacts that persist still today. River bank sandy sediment samples were collected from 17 localities distributed from 5 to 500 km downriver from the failed dam, including pre- and post-failure river bank sediment. The latter sediment is clearly distinguishable from the former for the distinct brownish color and finer (fine sand + silt) grain size. Two-component modelling of $^{143}\text{Nd}/^{144}\text{Nd}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios of the Doce River sediments show varying degrees of mixtures of three end member components: a) the juvenile Neoproterozoic magmatic arc granitoid rocks of the Araçuaí orogen, including the syn- and post-orogenic granitoid remelting products; b) the Archean-Paleoproterozoic São Francisco craton TTG associations and c) the iron-rich slurry, the tailing from the mined and processed primary Paleoproterozoic banded iron formation, which was massively released into the fluvial system (Valeriano et al., 2019). Increasingly juveniles signatures were observed downriver, influenced by the progressive incorporation of magmatic-arc derived debris from the bedrock. These isotope signatures are currently used to monitor the apportion of Rio Doce contaminated sediment into adjacent marin environment.

Reference: Valeriano, C.M., Neumann, R., Alkmim, A.R., Evangelista, H., Heilbron, Neto, C.A., Paravidini, G.S., 2019. Sm–Nd and Sr isotope fingerprinting of iron mining tailing deposits spilled from the failed SAMARCO Fundão dam 2015 accident at Mariana, SE Brazil. *Applied Geochemistry* 106 (2019) 34–44. <https://doi.org/10.1016/j.apgeochem.2019.04.021>.

